

**U. S. Navy COTS:
A Double-Edged Sword**



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Commercial Off the Shelf (COTS) products are defined as those products available to the general public or to be sold, leased, or licensed to the general public. Given the expanded use of COTS technology in weapons systems today, and the pace at which this technology changes, managing COTS evolutionary cycles and identifying technology refreshment opportunities becomes critical to successful life cycle support of fielded systems. The Tactical Advanced Computer-Four (TAC-4) did not effectively execute the planned COTS evolutionary cycle; therefore, many key issues must be addressed in order to avoid impacts on Fleet readiness. This is a formidable example of how mismanagement of technology can potentially affect weapons systems and supportability. Now, proactive measures, based on TAC-4 assessments conducted by NAVSEA, are in place to facilitate these actions. With proper alignment of management, visibility, monitoring, research, technology refresh and insertion, the depth and span of COTS systems and its components can be managed effectively.

There are both significant advantages and disadvantages for using COTS in our system/equipment designs. Exploiting one without the other is the biggest challenge facing our military today and tomorrow. As our systems continue to mature based not on our singular use designs, but on a kluge of both public and private interests, we find national security interests may not be in the stockholders' best interests.

COTS is a double-edged sword; cutting both ways. On the upside, less costly components, from lower manufacturing and design costs, can be amortized across a larger customer base. In addition, the research burden is no longer solely shouldered by the Defense Department. The downside of this; however, is that the product line is market driven, and as soon as diminishing returns on a production run is forecasted, retooling begins. This can lead to unsupportable systems within our Fleet (or life-of-type buy decisions) if material and money simultaneously match.

To further complicate matters, there are risk multipliers of the COTS double-edged sword. With the advent of acquisition reform, Program Managers are almost solely judged against cost, schedule and performance. With the rush to "get stuff, not fluff," and with the canceling of the old-world MIL-SPEC/MIL-STD acquisition process, we are seeing many more configurations. All of these with different, read "more costly" logistics tails, as well as design trade-off based off the availability of a given component, vice the merits of supportability, maintainability, or even reliability.

There are many challenges facing the Department of the Navy as a result of COTS. The inability to upgrade systems as often as today's technology requires, component obsolescence, lack of configuration management, lack of relevant information for market surveys, inadequate documentation and training, and parts substitutions without regard for system interfaces, are just a few of the life cycle support issues needing effective management.

Although the use of COTS products has drastically reduced the cost to design and develop a weapons system, lessons learned from early COTS projects spotlight the need to build long-term supportability and technology refresh avenues into the acquisition process. Rapidly changing COTS technology forces obsolescence issues challenging the

systems integrators' ability to provide support throughout the system's life cycle. COTS usage requires a carefully planned, budgeted and executed management and migration path. The Tactical Advanced Computer-Four (TAC-4) is an example of a program not effectively executing the planned COTS evolutionary cycle.

The TAC-4, the Navy's fourth generation of commercial systems designed to provide a technology refresh migration path for generic computer processing, was awarded to Hewlett Packard (HP) on January 19, 1995. It provided a vehicle for Navy, Marine Corp, Coast Guard, and other Department of the Defense (DoD) agencies to obtain Commercial-off-the-Shelf (COTS), state-of-the-art, computer hardware packaged for office environments or ruggedized for shipboard and tactical use. Under the TAC-4 contract, HP offered workstations and servers with peripheral equipment, software, maintenance, training, and support services. The TAC-4 contract provided DoD activities a means to integrate common computer equipment with ruggedization; local-area network capabilities, multi-level security, and data encryption into new applications and technology refresh efforts. TAC-4 computers support the requirements of System Commands, Type Commanders, Composite Warfare/Battle Group Commanders, as well as support activities and command centers. TAC-4 based systems have been integrated into a diverse range of DoD weapon systems, Combat systems, C4Is, and NTCSS/IT21s, as well as logistics and administrative support programs, such as SNAP I, SNAP II, and NALCOMIS. Over 2,000 TAC-4 systems were delivered to the Navy under the TAC-4 contract.

The TAC-4 contract had a three-year hardware-ordering period with an additional three years of maintenance, training, and services. Under the 72-month warranty period, which expired January 2001, the Navy was provided direct parts delivery, technical documentation, and technical support via a 1-800 help desk. Initially, there was a planned migration path and an expected 18-month refresh cycle. However, reduced defense spending and the lack of budgetary planning disrupted the plan's execution. As a result, the Navy now faces a significant challenge as the supportability requirements for the cadre of TAC-4 hardware installed in the Fleet migrates to the traditional stock system and program office infrastructures. The end of the TAC-4 warranty period has raised a number of key issues that must be addressed at the Navy wide level in order to guarantee a long-term support structure is established to avoid adverse impacts to Fleet readiness.

The Navy TAC-4 community depended heavily upon the Original Equipment Manufacturer (OEM) support structure and warranty process. Most program offices and weapon system integrators did not include the TAC-4 hardware suite in their system level supportability planning since there was an envisioned 18-month life cycle for the TAC-4, and the TAC-4 was based on commercial items supported via commercially integrated logistics and parts support. Unfortunately, an evolutionary technology refresh cycle for the TAC-4 was never implemented, and individual TAC-4 users are now faced with the requirement of ensuring their TAC-4 hardware platforms are supportable in the future. Currently, the Navy does not have a centralized program office or coordinating activity responsible for life cycle support of the TAC-4 program. Aggressive measures at the

Navy wide level are required to address the concerns raised by the TAC-4 user community and to establish a cohesive Navy support structure.

NAVSEA conducted a supportability assessment to evaluate key factors impacting life cycle support of the TAC-4 hardware suites installed in the Fleet. Historical information, specific system related information, Navy stock system data, and vendor product data, as well as OEM failure data, and TAC-4 community observations and concerns were collected to capture the range and depth of problems facing the TAC-4 community today. Major issues, such as the limited range and depth of available assets to support all the existing installations, as well as the lack of adequate technical documentation and training have been identified and correlated to the impact on the Fleet. Results have isolated ten life cycle supportability areas of concern, and stoplight evaluations were assigned to each. Specific recommendations mitigating risk and improving key supportability factors have been isolated for Navy wide implementation. Action completion will support a transition to the target status cited below within a two to three year time period.

<u>Assessment Area</u>	<u>Current Status</u>	<u>Target Status</u>
Asset Availability	Red	Yellow
Hardware Reliability	Yellow	Green
COTS Migration	Red	Yellow
Component Substitutions	Yellow	Green
Provisioning & Supply Support	Yellow	Green
Maintenance Philosophy	Red	Yellow
Engineering Technical Data	Red	Green
Configuration Control	Red	Green
Technical Manuals	Yellow	Green
Training	Red	Yellow

Stoptlight evaluations for the key TAC-4 supportability areas are distributed between yellow and red. However, the red areas have a significantly higher impact on Fleet readiness, self-sufficiency, and mission criticality. Therefore, an overall Navy wide TAC-4 supportability stoplight evaluation of red is warranted, especially since a key area requiring immediate action is asset availability and ensuring the Fleet can obtain the necessary replacement parts when a failure occurs. Assessment values of red usually indicated a system or function is non-operational and aggressive action must be taken within the next 12 months in order to recover. Stovepipe processes being implemented by various programs may be masking the problem's extent at a Navy wide level. The range, depth, and severity of the problem areas identified during this assessment, and the significant impact of these key supportability factors on the user community and the Fleet in general, substantiates the overall evaluation of red until appropriate safeguards to protect the Navy have been implemented.

Proactive measures, such as the supportability assessment and the surveys conducted by the TAC-4 User Group, are being taken as initial steps focusing attention on the various issues and challenges facing the TAC-4 community. Implementation of the recommendations formulated, as part of the assessment will support a transition to an overall Navy TAC-4 supportability evaluation of yellow within the next two to three

years. Aggressive Navy management and user community involvement facilitates the migration to an improved supportability infrastructure for the entire cadre of TAC-4 hardware integrated in the Navy today. The following areas will provide the foundation necessary for the TAC-4 life cycle support until all active service systems are removed.

- Assigning a single DoN facilitator whom coordinates and resolves logistics support issues.
- Implementing a Knowledge Management Tool to share and track TAC-4 information. Distance Support has an established a web site (anchordesk.navy.mil) facilitating data sharing among the TAC-4 user community.
- Identifying the entire TAC-4 user base and corresponding range of TAC-4 components used in the Fleet coupled with establishing adequate stocking levels for all active TAC-4 components.
- Increasing stocking levels for high failure rate items to cover near term requirements while investigating and implementing risk mitigation measures for maintenance drivers.
- Implementing processes to proactively manage and disseminate information regarding COTS migration, obsolescence, and interchangeability issues.
- Implementing DoN funding vehicle to support life-of-type buys, obsolescence, or technology refresh procurement efforts.
- Integrating methodologies to coordinate proposed TAC-4 provisioning changes.
- Ensuring the Fleet has tools, support material, and consumables necessary to support TAC-4 configuration and integrating those items into stock system and program related data.
- Reviewing each TAC-4 configuration maintenance philosophy ensuring all components are identified and properly supported from both a supply support and maintenance perspective; including an active postproduction support plan establishing a support structure through the end of the TAC-4 life cycle.
- Establishing troubleshooting, corrective maintenance support, and technical assistance through the existing Anchor Desk portal.
- Verifying the required range and depth of engineering and vendor documentation necessary to support the various TAC-4 configurations is available to the TAC-4 user community.
- Assigning a central TAC-4 configuration management point and implementing proven configuration control processes to manage configuration changes from a Navy perspective.
- Defining and implementing a corporate Navy approach to improving the technical level of the TAC-4 documentation and ensuring adequate documentation is provided to the Fleet.
- Implementing a Navy wide process to control and distribute OEM documentation needed to support the complete range of TAC-4 equipment installed in the Fleet.
- Investigating a Navy wide TAC-4 training path for operators and maintainers at all levels.

- Enabling and encouraging each TAC-4 user to conduct individual assessments on TAC-4 hardware platforms to ensure systems are supported throughout the projected life cycle.
- Integrating individual TAC-4 user “best practices” into the Navy wide TAC-4 supportability structure.

The TAC-4 warranty contract provided 100% sustainment support, which insulated the TAC-4 user community from the management and supportability issues surfacing from various Navy organizations. There are a number of significant risk areas requiring immediate attention to ensure continued life cycle supportability for the TAC-4. With aggressive centralized management and technical support, the Navy TAC-4 supportability posture will improve.

In order to avoid another TAC-4 type COTS circumstance, we continue to assess, evaluate, and change the manner in which we insert and life cycle manage COTS into our systems/equipment, and as such, the following initiatives have and will continue to enhance COTS usage.

In acknowledgement of the inherent risks associated with COTS systems and equipment, NAVSEA established the COTS Steering Board (CSB) under the Innovation and Technology Opportunities Thrust of the NAVSEA Strategic Plan. COMNAVSEA memo 5000 ser 00/054 of 21 Jul 00 promulgated the charter for the CSB. The Board has promulgated Best Practices via the NAVSEA COTS Guidance Document. There are disseminating examples of well-supported COTS usage. Additionally, the CSB has issued a Command-wide COTS policy document, which describes the minimally acceptable measures a program manager must consider as COTS are introduced into a given system design. These minimum measures are meant to ensure a Command-wide approach or course as chartered, and is not meant to slow down a good effort. The intention is to bring along those programs needing assistance.

The establishment of the NAVSEA CSB has provided NAVSEA managers access to proven tools and processes, via a comprehensive knowledge-based environment enabling the effective management and COTS products usage. The CSB, comprised of senior managers from within the NAVSEA corporate structure, represent the Program Executive Offices (PEOs) for the major product lines, SEA 04, SEA 05, the Naval Surface Warfare Center and the Naval Undersea Warfare Center. Other subject matter experts may, on a case-by-case basis, be asked to attend in support of specific issues. While individual Program Manager/PEOs are responsible for tailoring individual management structure to meet requirements, the CSB brings together key decision-makers familiar with current issues and are empowered to commit to and support any new initiatives or requests for assistance. The members shall assist the command and the PEOs in the review of COTS Management Plans and implementation as required. This board provides a platform for gaining efficiencies, sharing lessons learned, and facilitating the Navy communities understanding of the implications of fielding COTS based systems.

The Naval Sea Systems Command COTS Items / Non Developmental Items Website contains COTS strategies, as well as solutions and success stories to help the NAVSEA community effectively implement and manage COTS in Navy programs. However, the most important benefit will come from sharing information resulting from the aggregate user community experience. All NAVSEA activities and affiliated PEOs should contribute to these resources, so successes can be duplicated and mistakes minimized. The COTS Website provides the vehicle for sharing such information, which is an integral part of the success strategy in the implementation of COTS Items / Non Developmental Items in Navy systems.

The following are key enablers to better exploit COTS usage. These enablers are challenging and complex, especially when addressing in-service system life cycle support while trying to shape and influence the designs and acquisition of tomorrow's systems. The key components are COTS management plans, configuration management/visibility, commercial market place monitoring and research, trade-off analysis tools/decisions, when to use/not to use COTS in design, and budgeting for technology refresh/insertion.

COTS Management Plan

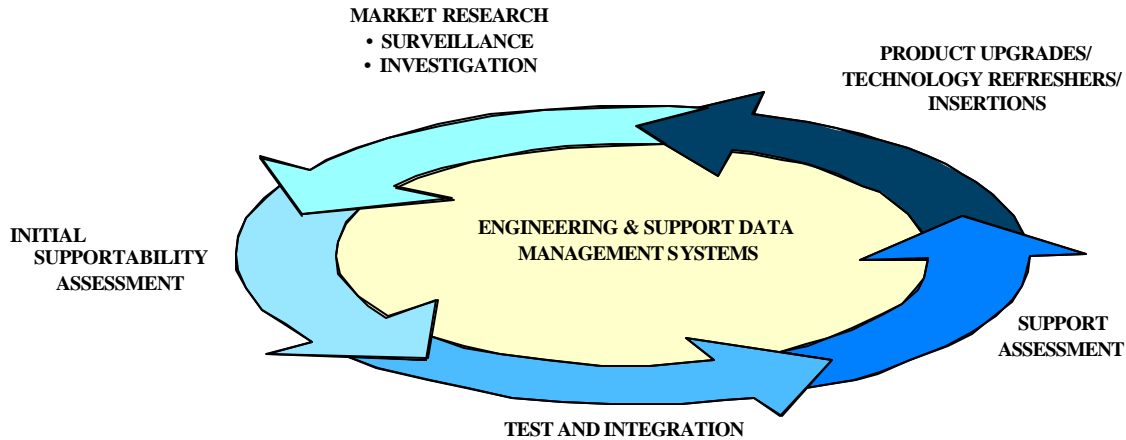
Logistics support, often the most difficult aspect of COTS acquisitions, depends on a support strategy developed early in the acquisition process. COTS Management consists of implementing integrated processes focused on monitoring the COTS environment, including:

- Market research, spanning surveillance and investigation of commercial products and technology trends.
- Supportability assessments of selected COTS products.
- Test and Integration of supportable COTS products.
- Continuous assessment of COTS products used in the Fleet.
- Proactive insertion of COTS product upgrades, technology refreshers, and technology insertions.
- Concurrent Engineering and Support Data Management.

This concept is used to ensure employed products remain within the broadest market to the maximum extent possible; thus, retaining the best potential for efficient life cycle support. In parallel, planned and budgeted system upgrades at the appropriate refresh cycle; will further promote achieving COTS management objectives.

The schematic shown below illustrates iterative and integrated application of the COTS management processes, as well as inherent interdependencies.

Interactive and Integrated COTS System Support Concept



Configuration Management (CM) and Visibility

CM visibility is the crucible in determining the depth and span of issues associated with COTS systems and its components. As the central repository for essentially all Navy components/systems, the weapons systems file (WSF) could provide a rapid and fairly comprehensive look at the breadth and depth of COTS components used in Navy systems. To support this initial survey, a query will be performed using the WSF to identify, to the extent possible, all COTS components used in the Navy Systems. This query can be done using a few existing fields as filters in order to isolate components managed under the COTS umbrella.

Commercial Market Place Monitoring and Research

Market research will leverage from both vendor and Navy markets to reduce development, production, and life-cycle support costs. Market research has the following components:

- ◆ Surveillance to stay abreast of advancements, changes, and trends.
- ◆ Investigation to determine the availability of an item for a specific application.

Design requirements include system performance, functionality, production, operation, and support sustainment criteria. System level design requirements, together with allocations for these requirements at the equipment level, provide focus to the market research process. Surveillance to identify potential Navy developments and COTS

technologies and vendors, combined with a focused investigation of the pertinent technologies, constitutes the front end of the market research process.

COTS products and technologies identified by market research, which unmodified, satisfy the necessary performance, functionality, and compatibility requirements are considered feasible COTS alternatives and are candidates for the supportability assessment process. The need to modify a COTS product may be a warning that features are being used the broader market does not typically require. Modifications vary from cosmetic or minor modifications, to major modifications significantly altering a product's performance. These modifications increase risk and force the product to move from off-the-shelf toward buyer unique.

Trade-Off Analysis Tools/Decisions on COTS Usage

The decision to use COTS, build to print, or implement some combination of COTS and a custom solution, requires a trade off analysis. Modifications, either technical to address a product's performance, characteristic or programmatic to adjust the vendor's process, will add to life cycle costs. At some point, the modifications a vendor is required to make will eliminate not only the short time-to-market and development cost benefits, but will also create a unique product that must be uniquely managed and maintained. Conducting trade-off analysis at the right time and on the right components or systems is key element to effective COTS management.

Budgeting for Technology Refresh and Insertion

COTS product research will ultimately lead to three general types of Engineering Changes:

- ***Technology Upgrades*** — a change as a result of integrating a next generation product or product upgrade to an existing technology or component to improve system functionality.
- ***Technology Insertion*** — a change as a result of integrating a new item or functional capability, which is a result of industry technology growth or military advance development.
- ***Technology Refreshers*** — a change as a result of integrating a new item to avoid end-of-life or product obsolescence issues or to resolve a problem identified by Fleet feedback.

The five-year POM cycle is much too long to address near term requirements of rapidly changing technology. Program managers often only have procurement dollars available, and no standard definition of terms and budgeting practices to deal with COTS. To take advantage of the effectiveness of COTS technology and avoid the adverse impact of unplanned obsolescence, there is a need to establish a budget line/authority for COTS technology upgrades, refresh and insertions.

OPNAV and NAVSEA are attempting to establish a centralized COTS requirements reporting process to ascertain the degree of COTS implementation problems. Centralized requirements reporting is considered to be the necessary first step to unilaterally view COTS as a whole system application instead of individual, small scale processes. Centralized requirements reporting can eventually lead to Navy-centric execution, allowing for increased latitude to those ready to execute procurements as well as to those beginning the process of searching for funds during a technology-introduction cycle. Additionally, the development of an acceptable Navy-wide centralized requirements reporting model is being considered. Finally, a centralized requirements reporting process will benefit the Office of Naval Research (ONR) to better align its efforts with those of the acquisition and life cycle management communities. Strengthening those relationships could optimize 6.1 and 6.2 research and development investments and greatly decrease the time necessary to introduce the latest technology to the Fleet.

Reasonable and reliable COTS applications have the capability to dramatically improve Fleet war fighting readiness while decreasing TOC over the short life of a system. I have proven to you that recent Navy experience with the TAC 4 has garnered many lessons learned, both on how to and how to not manage a COTS program. I have explained that a centralized Navy-wide bureaucracy must have the adequacy of resources to introduce, upgrade, and replace COTS systems in a disciplined manner. Finally, I have introduced you to the common tools we must use throughout the COTS management process. With the wise interpretation of our requirements, the judicious use of resources, and a fundamental understanding of our processes, we will improve our Navy now, as never before.